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1 Description

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3 High-voltage outdoor bushing arrangement

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5 The invention relates to a high-voltage outdoor bushing
6 arrangement having an electrically insulating casing and
7 switch-disconnector module which extends along an axis has an
8 electrically conductive housing, with a phase conductor which
9 can be interrupted into a first section and a second section by
10 means of an isolating gap and through the bushing arrangement.

11

12 A high-voltage outdoor bushing arrangement such as this is
13 known, for example, from US Patent No. 6,538,224 B2. The
14 arrangement there has a switch-disconnector module with a
15 separate gas area. The isolating gap is aligned along the phase
16 conductor, which can be interrupted into two sections. In
17 addition, one section of the phase conductor can be grounded by
18 means of a grounding switch. This design allows the switch-
19 disconnector module to be inserted into flange connections. In
20 order to ensure that the switch-disconnector module can be
21 inserted easily between a flange, a conventional switch-
22 disconnector arrangement must be used. In consequence, the
23 switch-disconnector module has a relatively large volume.

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25 The present invention is based on the object of specifying a
26 high-voltage outdoor bushing arrangement which has a compact
27 switch-disconnector module and a compact overall volume.

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29 In the case of a high-voltage outdoor bushing arrangement of
30 the type mentioned initially, the object is achieved according
31 to the invention in that a switching piece or an element of a
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1 multiple part switching piece can be moved at an angle to the
2 axis.

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4 The movement of the switching piece along an inclined movement
5 path results in better utilization of the space in the interior
6 of the electrically conductive housing. The inclined position
7 makes better use of the cross section of the housing, which is
8 governed by the flange openings, so that it is possible to
9 reduce the length in the direction of the axis. On the one
10 hand, this shortens the electrically conductive housing, while
11 on the other hand it reduces the overall length of the high-
12 voltage outdoor bushing. Alternatively, additional space is
13 available in the interior while retaining the previous housing
14 size, in order by way of example to arrange further components
15 within the housing.

16

17 It is also advantageously possible to provide for the
18 capability to ground at least one of the sections by means of a
19 grounding switch, which is arranged within the electrically
20 conductive housing, by continuation of a further movement of
21 the switching piece.

22

23 The space which is obtained by the inclined position of the
24 movement path of the switching piece can advantageously be
25 used, for example, to arrange a grounding switch. This
26 grounding switch may be in the form of a combination with the
27 switch disconnector, in order to further minimize the physical
28 space required. It is particularly advantageous in this case
29 for the movable contact piece of the isolating gap and a
30 movable contact piece of the grounding switch to be moved by a
31 common drive. For example, it is thus possible to provide for
32 the switching piece to move along an inclined path, and to be
33 in the form of a bolt. The bolt has contact areas at each of
34 its two ends, in which case one end can

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1 be used for switching the switching path, and the other end can
2 be used for switching the grounding switch. It is also possible
3 to provide for the switching piece to be in the form of a
4 plurality of parts, for example composed of a plurality of
5 elements which are connected to one another such that they can
6 move and are electrically coupled to one another. By way of
7 example, an embodiment of the switching piece in the form of
8 elements such as these also allows movements on curved paths.
9

10 It is advantageously also possible to provide for the movable
11 switching piece to be driven via a shaft which passes through
12 the essentially cylindrical housing.

13

14 An essentially cylindrical shape of the housing allows flexible
15 arrangement of the shaft for driving the movable switching
16 piece. The rotation axis of the shaft may, for example, be
17 arranged radially with respect to the axis. Alternatively, it
18 is also possible to provide for the axis to be skewed with
19 respect to the rotation axis of the shaft. If the drive for the
20 switching piece and the grounding switch are combined, only one
21 common shaft is required, and this passes through the housing.
22 This simplifies the housing design.

23

24 It is advantageously also possible to provide for the contact
25 piece to be in the form of a blade contact.

26

27 Switch disconnectors are intended to produce safe isolating
28 gaps in a phase conductor. As such, the contact systems of
29 switch disconnectors are subject only to a minor load resulting
30 from switching arcs, since the switch disconnectors are
31 switched with no current flowing. Blade contacts represent a
32 cost-effective variant for a switching contact. One
33 particularly simple embodiment in this case is for the
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1 blade contacts to move on a pivoting path and to be able to
2 move into mating contacts in the form of slots.

3

4 It is also advantageously possible to provide for the contact
5 piece to be in the form of a pin.

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7 In comparison to blade contacts, contacts in the form of pins
8 require increased manufacturing effort. Despite the fact that
9 switch disconnectors are switched with no current flowing, it
10 is possible for arcs to occur on isolating switching contacts
11 as well, for example because of charging phenomena. Contacts in
12 the form of pins are more resistant to arc loads.

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14 It is also advantageously possible to provide for the isolating
15 gap to be held in the housing via pillar supports.

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17 The use of pillar insulators to hold the isolating gap allows
18 the isolating gap to be arranged very flexibly within the
19 encapsulating housing. Furthermore, the supporting insulators
20 allow an insulating gas to flow around comprehensively and to
21 flow through the encapsulating housing. By way of example, the
22 use of supporting insulators makes it possible to dispense with
23 the use of partition insulators. If there are no sections which
24 need to be partitioned, this increases the available volume of
25 insulating gas within a gas area. This improves the cooling of
26 the contact areas of the switch disconnector.

27

28 It is also advantageously possible to provide for the contact
29 piece to be able to move on a curved path.

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1 A curved path such as this allows switching movements to be
2 carried out even in the immediate vicinity of the wall of the
3 encapsulating housing. A curved path movement such as this may
4 be achieved, for example, by the contact piece being designed
5 in the form of elements. Furthermore, a curved path can also be
6 achieved by pivoting a contact piece around a pivoting axis.
7 Better utilization of the available space makes it possible,
8 for example, to reduce the volume of the encapsulating housing,
9 or else to increase the current carrying capacity of the high-
10 voltage outdoor bushing arrangement.

11
12 It is advantageously also possible to provide for the shaft to
13 pass through an outer wall of the housing in a cylindrical area
14 of the housing.

15
16 Arrangement of the shaft in the cylindrical area of the
17 encapsulating housing allows the drive movement to be
18 introduced into the encapsulating housing relatively centrally.
19 The isolating switch or else the grounding switch can then be
20 arranged around this introduction point.

21
22 One exemplary embodiment of the invention will be described in
23 more detail in the following text and is illustrated
24 schematically in a drawing, in which:

25
26 Figure 1 shows a first embodiment variant of a high-
27 voltage outdoor bushing arrangement,

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29 Figure 2 shows a second embodiment variant of a high-
30 voltage outdoor bushing, and

31
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Figure 3 shows a third embodiment variant of a high-voltage outdoor bushing.

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4 The high-voltage outdoor bushings illustrated in figures 1, 2
5 and 3 are designed identically. Only the configuration of the
6 isolating gaps differ from one another.

7

8 First of all, the basic design of a high-voltage outdoor
9 bushing will be explained with reference to the exemplary
10 embodiment illustrated in figure 1. The high-voltage outdoor
11 bushing 1 has an electrically conductive housing 2. The
12 electrically conductive housing 2 is manufactured, for example,
13 from aluminum or from some other metal. The electrically
14 conductive housing 2 is preferably produced by means of a
15 casting process. The housing 2 is arranged essentially
16 rotationally symmetrically around an axis 3. The electrically
17 conductive housing 2 has a first flange 4 and a second flange
18 5. The first and the second flange 4, 5 are likewise arranged
19 coaxially with respect to the axis 3. An insulating casing 6 is
20 flange-connected to the first flange 4. The insulating casing 6
21 is in the form of an outdoor bushing, in a known manner. The
22 electrically insulating casing 6 and the housing 2 surround a
23 common gas area, which is filled with an insulating gas. The
24 insulating casing 6 is arranged coaxially with respect to the
25 axis 3. Furthermore, an electrical phase conductor is arranged
26 coaxially with respect to the axis 3. The electrical phase
27 conductor has a first section 7 and a second section 8. The
28 first section 7 of the phase conductor is surrounded by the
29 insulating casing 6, and is passed to the exterior of the free
30 end of the insulating casing 6. The first section 7 of the
31 phase conductor is passed through the first flange 4

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1 into the interior of the electrically conductive housing 2. The
2 second section of the phase conductor is passed through the
3 second flange 5 into the interior of the electrically
4 conductive housing 2. The second flange 5 is arranged at the
5 end of a tubular connecting stub 9. The tubular connecting stub
6 9 is likewise arranged coaxially with respect to the axis 3.
7 The tubular connecting stub 9 is surrounded by a toroidal
8 current transformer 10. An isolating gap 11 is arranged in the
9 interior of the electrically conductive housing 2. The
10 isolating gap 11 is formed from a fixed-position contact piece
11 12 and movable contact piece 13. The fixed-position contact
12 piece 12 is electrically conductively connected to the first
13 section 7 of the phase conductor, which passes through the
14 first flange 4. The fixed-position contact piece 12 as well as
15 the first section 7 of the phase conductor are held in an
16 isolated manner in the interior of the housing 2 via a
17 supporting insulator 14a in the form of a pillar. The second
18 section 8 of the phase conductor, which is passed through the
19 second flange 5, is likewise mounted in an isolated manner in
20 the interior of the electrical housing 2 by means of a further
21 supporting insulator 14b in the form of a pillar. The movable
22 contact piece 13 is in the form of a bolt. The bolt can be
23 moved along its bolt longitudinal axis, along a linear path at
24 an angle to the axis 3. In order to drive the movable contact
25 piece 13, a shaft 15 is passed through the wall of the
26 electrically conductive housing 2 in a cylindrical area of it.
27 The shaft 15 is in the form of an electrically insulating
28 shaft. The rotary movement of the shaft 15 is converted to a
29 linear movement of the movable contact piece 13 via a rocker
30 which is arranged on the shaft 15. At its end-face end, the
31 movable contact piece 13 has a contact area which can be
32 inserted into the fixed-position contact piece 12 of the
33 isolating gap 11. A contact area is arranged at that end of the
34 movable contact piece 13 which is remote from the isolating gap
35 11

1 and can be inserted into a grounding contact 16 which is
2 arranged in the interior of the electrically conductive housing
3 2. As the opening movement of the movable contact piece 13
4 continues, contact is made with the grounding contact 16. This
5 allows the second section 8 of the phase conductor to be
6 grounded.

7

8 The high-voltage outdoor bushing arrangement illustrated in
9 figure 2 has a design which is the same as that shown in figure
10 1 in terms of the electrically conductive housing 2 and the
11 insulating casing 6, as well as the flanges 4, 5. The only
12 modification from figure 1 is the contact system for the
13 isolating gap. The fixed-position contact piece 12 is once
14 again arranged on the first section 7 of the phase conductor.
15 The movable contact piece 13 is in the form of a bolt with a
16 plurality of elements and can be moved along the axis 3. The
17 movable contact piece 13 is driven via a shaft 15 which passes
18 through the wall of the electrically conductive housing 2. The
19 movable contact piece 13 is formed in two parts. The movable
20 contact piece 13 has a grounding contact 13a in the form of a
21 bolt. The grounding contact 13a in the form of a bolt can move
22 along a movement path which is arranged at an angle to the axis
23 3. In this case, the movable contact piece can be driven in
24 such a way that a connecting rod in each case strikes against
25 the free end of a rocker which is connected to the shaft 15,
26 and this connecting rod is in each case connected to the
27 movable contact piece 13 and to the grounding contact 13a. The
28 connecting rod converts the rotary movement to respective
29 linear movements, respectively along the axis 3 and
30 transversely with respect to the axis 3, thus resulting in a
31 curved path being formed.

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33

1 Figure 3 shows a high-voltage outdoor bushing arrangement which
2 has an isolating gap 11 formed by a blade contact 20 which can
3 pivot. The blade contact 20 which can pivot is mounted on the
4 second section 8 of the phase conductor, such that it can
5 rotate. A first striking contact 21 is arranged on the first
6 section 7 of the phase conductor. The isolating gap 11 is
7 closed during a pivoting movement of the blade contact 20 as it
8 is knocked into the first striking contact 21. Furthermore, a
9 grounded second striking contact 22 is arranged in the interior
10 of the electrically conductive housing 2. During the opening
11 movement of the isolating gap as this pivoting movement
12 continues beyond a neutral position of the blade contact 20,
13 this is knocked into the second striking contact 22, and thus
14 grounds the second section 8 of the phase conductor. In its
15 neutral position, the blade contact 20 is covered by shielding
16 shrouds which make electrical contact with the second section 8
17 of the phase conductor.

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